

## **Aerospace America (AIAA article)**

### **Materials**

#### **Automated Composites Processing Technology: Film Module**

**Author: A. Bruce Hulcher**

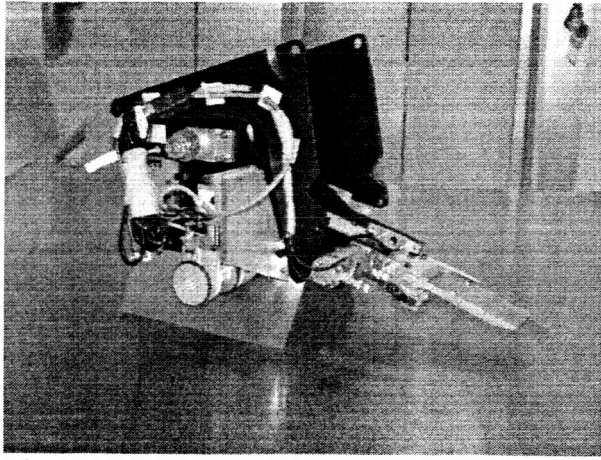
NASA's Marshall Space Flight Center (MSFC) has developed a technology that combines a film/adhesive laydown module with fiber placement technology to enable the processing of composite prepreg tow/tape and films, foils or adhesives on the same placement machine. The development of this technology grew out of NASA's need for lightweight, permeation-resistant cryogenic propellant tanks. Autoclave processing of high performance composites results in thermally-induced stresses due to differences in the coefficients of thermal expansion of the fiber and matrix resin components. These stresses, together with the reduction in temperature due to cryogen storage, tend to initiate microcracking within the composite tank wall. One way in which to mitigate this problem is to introduce a thin, crack-resistant polymer film or foil into the tank wall. Investigation into methods to automate the processing of thin film or foil materials into composites led to the development of this technology.

The concept employs an automated film supply and feed module that may be designed to fit existing fiber placement machines, or may be designed as integral equipment to new machines. This patent-pending technology can be designed such that both film and foil materials may be processed simultaneously, leading to a decrease in part build cycle time. The module may be designed having a compaction device independent of the host machine, or may utilize the host machine's compactor. The film module functions are controlled by a dedicated system independent of the fiber placement machine controls. The film, foil, or adhesive is processed via pre-existing placement machine run programs, further reducing operational expense.

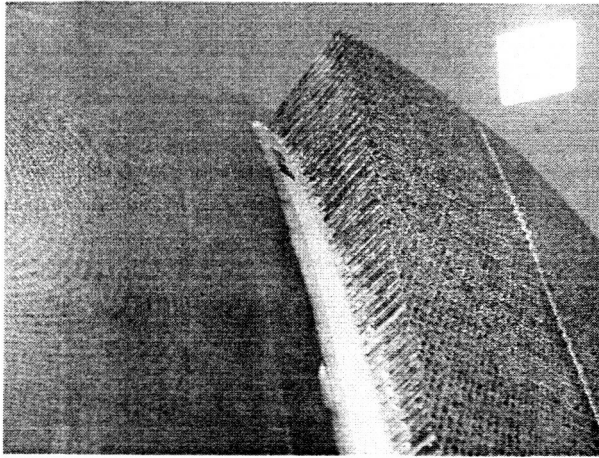
A prototype film module device has been designed for use on the NASA MSFC's Viper 7-Axis fiber placement machine. This device is 17-in. in length, 8.5 in. wide, and 10 in. in height and weighs 12.5 lbs. Physical attachment of the module to the machine head was made possible by existing head hardware connection points. Installation of the module onto the machine placement head may be accomplished in less than one-hour. Other components of this system include a device control cabinet and a hand pendant that enables the manual operation of film feed and cut, as well as emergency stop actions.

Materials that may be processed using this technology include thermoset and thermoplastic films, metallic foils, honeycomb and foam core adhesives, joining adhesives, lightning-strike protection materials, and embedded sensor arrays. The device may be designed to process a number of materials thicknesses and widths.

Those interested in learning more about this technology are encouraged to contact Sammy Nabors at the NASA MSFC Technology Transfer Office (256.544.5226, [sammy.nabors@nasa.gov](mailto:sammy.nabors@nasa.gov)).



The NASA film module processing technology may reduce costs associated with fiber placement processing of hybridized composite materials, and may enable fabrication of novel laminate designs.



This technology may also be employed in the automated processing of core adhesives in composite structures.